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GETTING IT RIGHT

COLLABORATING FOR MISSION SUCCESS

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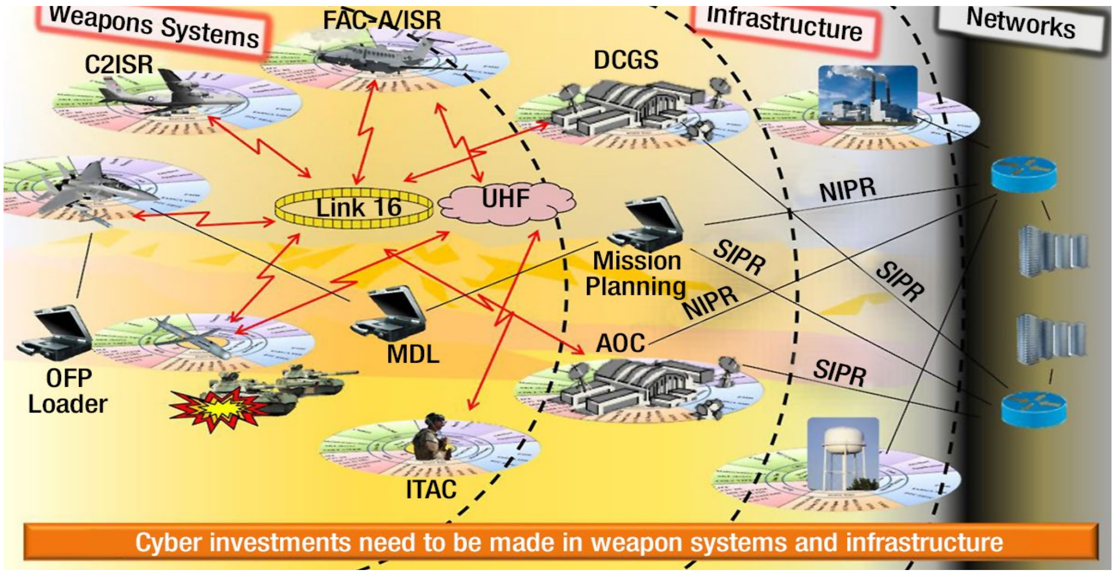
FAST-TRACKING RISK ASSESSMENT



Courtesy of AFLCMC

By DANIEL C. HOLTZMAN, HQE
Director, Cyberspace Innovation,
United States Air Force

The U.S. Air Force recognized that its implementation of the Authorization to Operate (ATO) approval process had become very resource-intensive, adhering to an antiquated checklist/compliance-based behavior compared with outcomes not keeping pace with the latest cyber threats that affected its weapon systems. While the ATO process is an important contributor to the critical tasks of implementing cybersecurity and managing cyber risk, delays in fielding new systems

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RESILIENCE IN SPACE

By MAJ GEN SANDRA FINAN
(USAF, Ret)
Advisor, Pacific Northwest National Laboratory

Resilience is especially critical in space. As we all know, space is a dangerous place and a constant threat to our mission success. This is because (1) the environment is extremely hostile and unforgiving, where the smallest incident can threaten life and mission; (2) the great distances involved make arrival of timely assistance unlikely; and (3) we have enemies that can and will threaten us in this environment. These, and many other reasons, are why resilience in space must be a focus area.

Our future in space will include a hyper-connected infrastructure with dependencies between digitally controlled elements. This combination of devices and interconnections is far outpacing the ability of humans to fully understand system states and adequately pursue assaults to the system. Our attack surface is expanding, and we need a new approach, autonomic resilience, for our security and resiliency.

Autonomic resilience shifts the perspective from securing individual devices to looking at complex interdependent systems holistically. We must drive science to understand holistic system behaviors that can indicate either a good state (resiliency) or abnormal behavior—such as disturbances caused by natural hazards, deliberate attacks, or a combination of assaults on a system. In the end we need to be able to sense what is happening, model potential futures, and maneuver to avoid or lessen the effect of an assault before that assault occurs. We must do this in fractions of a second. And because human operators must trust these systems, the decision-making inside autonomic resilience must be

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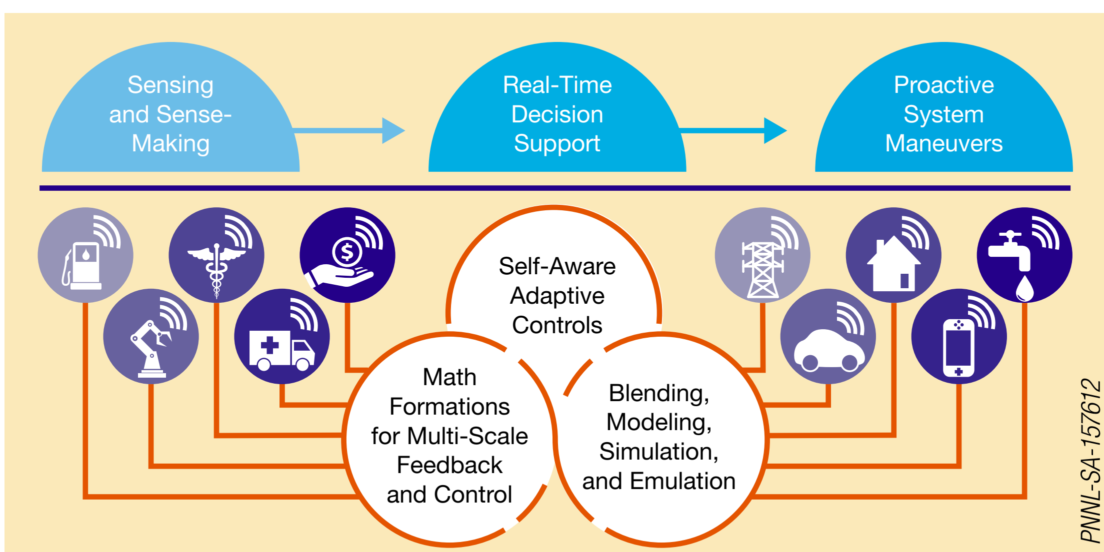


SPACE SYSTEMS SOFTWARE DEVELOPMENT STANDARD

By VALE T. SATHER
The Aerospace Corporation

The updated software development standard (TR-RS-2020-00012) removed much of the heavy documentation required by the traditional software development method that emphasized achieving the highest Capability Maturity Model Integration maturity. The objective of the update was to capture key software development practices regardless of the development method and to better accommodate the use of newer tools. With the wider application of hybrid software development methods, program offices should enlist the help of appropriate software subject matter experts to tailor the standard according to the specific method being applied.

The updated standard includes more references to other software standards to avoid duplicate or conflicting requirements, which is consistent with IEEE and ISO standards. The referenced software standards include configuration management and cyber standards. Aligning the software development standard with other recommended standards ensures that the appropriate subject matter experts are leveraged and coordinated on both system and software tasks. In this way, software development will and should be considered at the system level rather than as a separate siloed unit.

The new standard has greatly streamlined the number of requirements and deleted the mandatory appendices that explicitly specified format and content of contract data requirements list items that may not be applicable to some of the newer software development methods (e.g. agile and DevSecOps). Those appendices or tailored versions will be included in future guidance documents for specific software development methods.

The updated software development standard will reduce software cost by imposing fewer requirements on the contractors and foster greater coordination between the system and software engineers on a subset of common tasks. Coordination between systems engineering and software engineering is a critical element in successful software developments, particularly with the newer agile methods. The goal of the standard is to bridge system and software engineering tasks early in the system acquisition lifecycle.

For more information contact Vale Sather at vale.t.sather@aero.org, 310.321.8512.

OUTPACING THE THREAT THROUGH INTEGRATION ACROSS THE SPACE ENTERPRISE

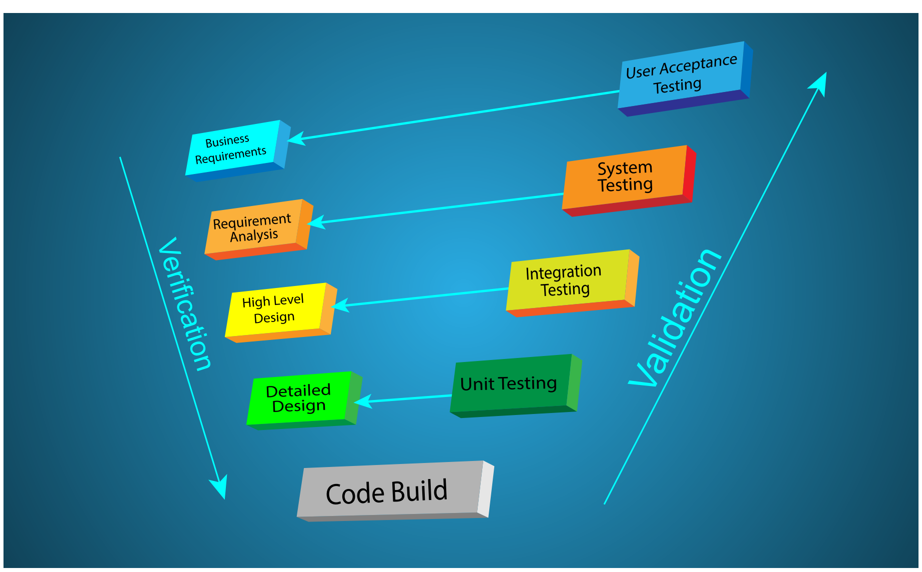
By MARK J. SILVERMAN
The Aerospace Corporation

The recognition that space is a warfighting domain has changed how The Aerospace Corporation's customers across the Department of Defense (DOD), intelligence community, civil space programs, allied organizations, and commercial space segments approach mission assurance. The unstated model of the past focused on segment mission assurance. For the modern space enterprise dominating the threat requires an integrated approach to ensure delivery of critical capabilities in a contested environment.

Aerospace is uniquely positioned to increase up-front customer engagement across the space enterprise to achieve end-to-end mission success across customers and mission areas. The goal is to develop integrated perspectives and solutions leveraging our unique role as the FFRDC for the space enterprise.

Aerospace is taking a two-pronged approach toward this objective. First, there are numerous initiatives internally to optimize communication across organizations, ensuring that Aerospace guidance across the space enterprise is founded on commonly understood facts and assumptions. Second, Aerospace is developing processes and tools to identify specific challenges and opportunities that would be well addressed by the combined efforts of our customers. With these approaches well underway, we are confident that we will help customers find partners and solutions to meet the evolving challenges they face. With Aerospace's broad reach across the space enterprise, it is a responsibility we embrace.

For more information, contact Mark Silverman, mark.j.silverman@aero.org, 310.336.0671.



AUTOMOBILE TRANSFORMATION DRIVES SPACE INNOVATION

By JEFF JURANEK
The Aerospace Corporation

In the late 1980s the U.S. automotive industry was facing the "valley of death," suffering from poor quality products, low productivity, and high costs. Meanwhile Japanese automotive companies were building automobiles of significantly higher quality and reliability, producing them more efficiently with shorter cycle times. With much introspection, U.S. automakers studied the Japanese design and production methods, leading to a transformation of the U.S. auto industry. This begs the question: can the space industry learn anything from the automotive industry?

Here are some of the key automotive lessons learned that can provide valuable insight into high-volume production (HVP) for space systems:

- Engineering and manufacturing not working as an integrated team (i.e., working in silos) results in "over-the-wall engineering" and products that are non-conforming due to variability that is not addressed across organizational departments
- 70% of a product's cost is in design—invest in design quality and simplification
- Cost is associated with cycle time, and time is money; therefore, efficiency must be addressed
- Building a product using "flow manufacturing and a product layout" is the most efficient method of high-volume production
- Automotive production part approval process enables higher levels of repeatability required to support high production rates

Luckily, there is a set of design and production approaches that addresses these challenges. Robust Design methods and Lean Production methods, when used together, collectively improve the design quality and efficiency of products designed and built. The graphic shown illustrates the collective interface between the two approaches and the specific methods that are used in the automotive industry.

Robust Design methods improve product quality by reducing the sensitivity of product performance due to variations in parts, materials, manufacturing processes, and the operating environment. All these methods are used during the design phase to create a robust product design that has been optimized for cost, simplicity, and producibility.

Lean Production methods eliminate inefficiency throughout manufacturing. Special emphasis is placed on operational efficiency that is caused by waste, unevenness, and overburden in manufacturing processes. A collection of methods (as shown in the figure) is used in manufacturing to address this waste. The basic idea is to develop uniform systems that ensure repeatability and consistency of processes.

Production Part Approval Process is a rigorous standard used in the automotive industry to ensure that all manufacturing processes consistently produce high-quality parts at the required production rates. This is referred to as "run-at-rate production." There is additional rigor applied to automotive HVP that is not common in the space industry: (1) performing design failure modes and effects analysis to every product level (not just the subsystem level), (2) performing process failure modes and effects analysis on every manufacturing process, and (3) performing measurement systems analysis (a.k.a. gauge repeatability and reproducibility studies) on processes to eliminate sources of measurement error.

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RECENT GUIDANCE AND RELATED MEDIA

Radically Designing the U.S. Space Force by R.R. Rumbaugh; OR-2020-01038; USGC

An Overview of Navigation with Proliferated Low Earth-Orbit Constellations by J. Won; TOR-2020-01845; USGC

Very Large LEO Constellation Impact on Space Operations by G.E. Peterson; TOR-2020-01949; USGC

Defining the "Allocated Baseline" for GBSD in the MBSE Context by M.W. Maier; TOR-2020-01977; Distribution authorized to the Department of Defense and U.S. DOD contractors

Small Satellite Technology Survey—Thermal Control Systems by J.E. Ingersoll; TOR-2020-02176; USGC

Small Satellite Technology Survey—Communications Systems by A. Seto-Mook; TOR-2020-02453; USGC

Cost Uncertainty Analysis in Constellation Architecture Studies by M.W. Maier; ATR-2020-00409; PR

Digital Engineering Strategy Accelerators—Benefits and Approach by A.C. Hoheb; ATR-2020-01688; PR

Lithium-Ion Battery Tailoring for AIAA S-122-2007, Electrical Power Systems for Unmanned Spacecraft by J. Walker; TR-RS-2020-00030; PR

Correlation-based RPO Assessment (CoBRA) Tool Description and User's Guide by A. Binder and J. Munoz; TOR-2020-01289; Distribution authorized to DOD agencies and their contractors

The Test Like You Fly Process—Creating Operationally Realistic Tests and Finding Mission-Critical Faults Before It's Too Late by J. White and L. Tilney; TOR-2020-01293; USGC

Pre-Award Tracing from Acquisition Strategy to Model Contract by A.C. Hoheb; ATR-2020-01357; PR

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USG = Distribution authorized to U.S. government agencies only
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AUTOMOBILE TRANSFORMATION DRIVES SPACE INNOVATION

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As we move into high-volume production of space systems, some of the key focus areas to ensure successful build and delivery are:

- A stricter stance/emphasis on repeatable quality will be required for HVP of space systems
- To achieve high-quality products, sources of excess variation should be understood and controlled
- On-time delivery of parts (that work as intended) is required to support HVP

A two-pronged approach is needed—with opportunities on both the design side and manufacturing side to realize HVP of space systems.

REFERENCE

Aerospace Report No. ATR-2020-01711*

* Distribution is limited—please contact library to obtain a copy.

For more information contact Jeff Juranek, jeff.b.juranek@aero.org, 310-648-2020.

RESILIENCE IN SPACE

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transparent and understandable by humans.

Autonomic resilience is critical to our national security in space and on Earth. Pacific Northwest National Laboratory is developing a technology capability roadmap with partners and key decisionmakers. PNNL hopes to inspire a multidisciplinary call to arms for innovative, effective research programs that will enable autonomic resilience.

For more information contact Maj Gen (Ret) Sandy Finan, sandra.finan@pnnl.gov, 509.371.7733.

2020–21 EVENTS

December 16–17 *SIA's Virtual DOD Commercial SATCOM Workshop, Virtual*

February 9–11 *Microelectronics Reliability and Qualification Workshop (MRQW), Virtual*

March 1–15 *25th Annual Ground System Architectures Workshop (GSAW), Virtual*

April 19–22 *Space Power Workshop (SPW), Virtual*

April 20–22 *AIAA Defense and Security Forum (AIAA DEFENSE Forum), Laurel, Maryland, USA*

FAST-TRACKING RISK ASSESSMENT

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bring their own risks by extending the use of legacy (often less secure) capabilities. This represented a gap in the ability for the Air Force to move toward more agile, operationally focused, risk-based outcomes. The development of the Air Force Fast-Track process addresses this identified gap.

The Fast-Track process gives authorizing officials (AOs) the discretion to make decisions based on foundational systems-engineering-based evidentiary data and analysis. With an independent review of the combination of a cybersecurity baseline, a risk assessment, and a continuous monitoring strategy, AOs are given the ability to make operationally informed risk decisions. Working closely with the acquisition community, the information system owners and warfighters Fast-Track applications seek to find an appropriate balance between rapid deployment and an appropriate level of risk identification and management. The foundations of this Fast-Track philosophy is to understand the systems: how they work; how they operate; the data that is imported, generated, and exported; and where the systems present cyber risks in order to better inform AF decision makers on usage risks.

After more than two years of pathfinder implementation on over 80 weapon systems, including command and control, aircraft, radar, DevSecOps applications, experiments and exercises, and cloud infrastructure and applications, documenting the increased mission assurance to missions and reduction in time and resources, the AF Under Secretary directed Fast-Track ATO as the primary process for the Department of the Air Force to assess risk for new IT, new platform systems, and for renewing ATOs on October 19, 2020.

The pathfinders demonstrated the cyber risk management process can be more effectively and efficiently executed based on solid, foundational systems engineering and treating cyber risks equally with other program risks. The spirit of the Fast-Track ATO process calls for integrating the acquisition, test, and operations communities toward a single objective of assessing and determining the risk of use of systems and missions to (1) better inform mission owners, and to (2) demonstrate that the Air Force can document improvement over time in making our systems more secure today than yesterday.

The Fast-Track ATO process is designed to be a living process, compared to compliance to another set of static, specific steps. AOs are given the ability to best implement the spirt of the Fast-Track ATO process to effectively implement aspects of the Risk Management Framework, focus on operationally informed risk identification, and ensure clinical risk assessments for AF systems and missions.

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Getting It Right is published every three months by the Corporate Chief Engineer's Office within the Office of the Executive Vice President of The Aerospace Corporation. Direct questions and comments to gettingitright@aero.org.

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